

1. Part Numbering System:

<u>CP</u>	<u>03</u>	<u>J</u>	<u>A</u>	<u>10K</u>
<u>Series Name</u> CP: Thick Film High power Chip Resistors	<u>Type</u> Inch (mm) 02-0402(1005) 03-0603(1608) 05-0805(2012) 06-1206(3216) 10-1210(3225) 0A-2010(5025) 12-2512(6432)	<u>Tolerance</u> B= $\pm 0.1\%$ D= $\pm 0.5\%$ F= $\pm 1\%$ J= $\pm 5\%$ P : Jumper	<u>Package</u> A=4Kpcs/7"Reel B=5Kpcs/7"Reel C=10Kpcs/7"Reel M=15Kpcs/7"Reel D=10Kpcs/10"Reel E=20Kpcs/10"Reel	<u>Resistance</u> 1R2=1.2 Ω 10K=10K Ω 10K5=10.5K Ω 100K=100K Ω 1M2=1.2M Ω

2.FEATURE

- High power rating and compact size
- High reliability and stability
- Reduced size of final equipment
- RoHS 2 compliant with exemption 7C-I and Halogen free products
- Flame Retardant

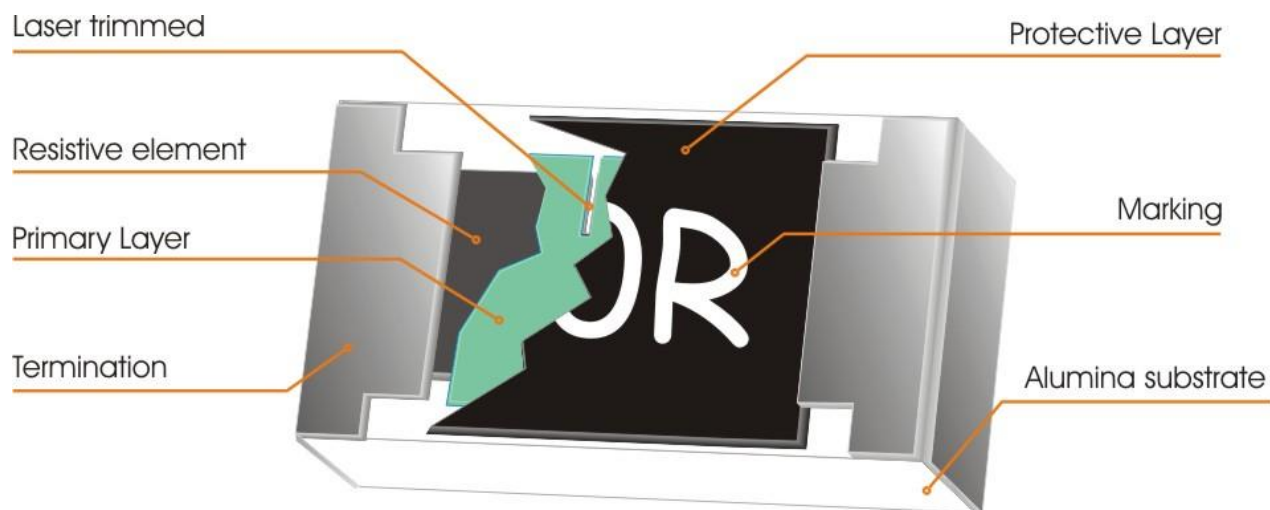
3.APPLICATION

- Power supply
- PDA
- Digital meter
- Computer
- Automotives
- Battery charger
- DC-DC power converter

3.DESRIPTION

The resistors are constructed in a high grade ceramic body (aluminum oxide). Internal metal electrodes are added at each end and connected by a resistive paste that is applied to the top surface of the substrate. The composition of the paste is adjusted to give the approximate resistance required and the value is trimmed to nominated value within tolerance which controlled by laser trimming of this resistive layer.

The resistive layer is covered with a protective coat. Finally, the two external end terminations are added. For ease of soldering the outer layer of these end terminations is a Tin (lead free) alloy.



Construction of Chip-R

5. QUICK REFERENCE DATA

Item	General Specification						
Series No.	CP12	CP0A	CP10	CP06	CP05	CP03	CP02
Size code	2512 (6432)	2010 (5025)	1210 (3225)	1206 (3216)	0805 (2012)	0603 (1608)	0402 (1005)
Resistance Tolerance	$\pm 1\%$, $\pm 0.5\%$, $\pm 0.1\%$ (E24+E96), $\pm 5\%$ (E24)						
Resistance Range	0 Ω , 1 Ω ~ 1M Ω			0 Ω , 1 Ω ~ 10M Ω		0 Ω , 1 Ω ~ 1M Ω	
TCR (ppm/ $^{\circ}$ C) 10.2 Ω ~ 1M Ω < 10 Ω	± 100 ± 100	± 100 ± 100	± 100 ± 100	± 100 ± 200	± 100 ± 150	± 100 ± 150	± 100 -200/+400
Max. dissipation at $T_{amb}=70^{\circ}$ C	2 W	1 W	1/2 W	1/2W	1/4 W	1/8 W	1/8 W
Max. Operation Voltage	300V	200V	200V	200V	150V	50V	50V
Max. Overload Voltage	500V	400V	400V	400V	300V	100V	100V
Operation Temperature	- 55/+155 $^{\circ}$ C						

Note :

- This is the maximum voltage that may be continuously supplied to the resistor element, see "IEC publication 60115-8"
- Max. Operation Voltage : So called RCWV (Rated Continuous Working Voltage) is determined by

$$RCWV = \sqrt{\text{Rated Power} \times \text{Resistance Value}}$$
or Max. RCWV listed above, whichever is lower.
- 2W loading with total solder-pad and trace size of 300 mm²

TEST CONDITION FOR JUMPER (0 Ω)

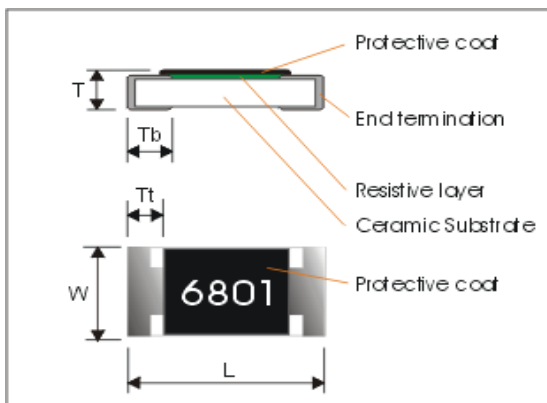
Item	CP12P	CP0AP	CP0AP	CP06P	CP05P	CP03P	CP02P
Power Rating	2W	1W	1/2W	1/2W	1/4W	1/8W	1/8W
Resistance	Max. 20m Ω	Max. 20m Ω	Max. 20m Ω	Max. 20m Ω	Max. 20m Ω	Max. 20m Ω	Max. 50m Ω
Rated Current	10A	7A	5A	5A	4A	2A	1.5A
Peak Current	25A	17.5A	12.5A	12.5A	10A	5A	3.8A
Operating Temperature	-55 ~ +155 $^{\circ}$ C						

Item	CP0AF	CP10F	CP06F	CP05F	CP03F
Power Rating	3/4W	1/2W	1/4W	1/8W	1/10W
Resistance	Max. 10m Ω	Max. 10m Ω	Max. 10m Ω	Max. 10m Ω	Max. 10m Ω
Rated Current	6A	6A	5A	4A	3A
Peak Current	12A	12A	10A	8A	6A
Operating Temperature	-55 ~ +155 $^{\circ}$ C				

6.MECHANICAL DATA

Unit: mm

Symbol	CP12	CP0A	CP10	CP06	CP05	CP03	CP02
L	6.30 ± 0.20	5.00 ± 0.20	3.20 ± 0.20	3.20 ± 0.20	2.00 ± 0.10	1.60 ± 0.10	1.00 ± 0.05
W	3.20 ± 0.20	2.50 ± 0.20	2.60 ± 0.15	1.60 ± 0.15	1.25 ± 0.10	0.80 ± 0.10	0.50 ± 0.05
T	0.60 ± 0.15	0.60 ± 0.10	0.55 ± 0.10	0.55 ± 0.10	0.50 ± 0.15	0.45 ± 0.15	0.35 ± 0.05
Tt	0.60 ± 0.25	0.60 ± 0.25	0.50 ± 0.25	0.50 ± 0.25	0.40 ± 0.20	0.30 ± 0.10	0.20 ± 0.10
Tb	0.60 ± 0.25	0.60 ± 0.25	0.50 ± 0.25	0.50 ± 0.25	0.40 ± 0.20	0.30 ± 0.15	0.25 ± 0.10



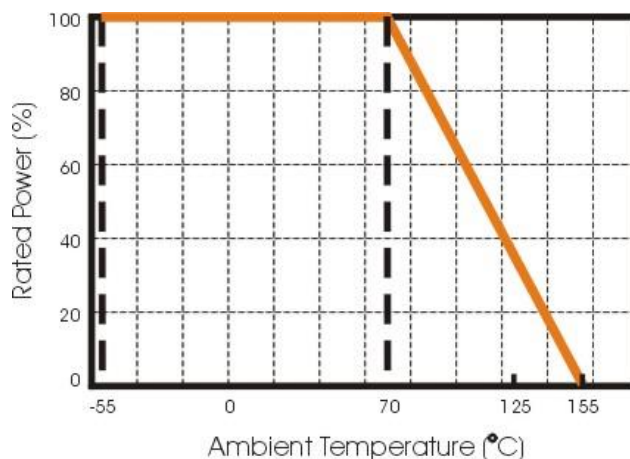
7.FUNCTIONAL DESCRIPTION

7.1Product characterization

Standard values of nominal resistance are taken from the E96 & E24 series for resistors with a tolerance of $\pm 5\%$ & $\pm 1\%$. The values of the E24/E96 series are in accordance with "IEC publication 60063".

7.2 Derating curve

The power that the resistor can dissipate depends on the operating temperature; see The figure below



Maximum dissipation in percentage of rated power as a function of the ambient temperature

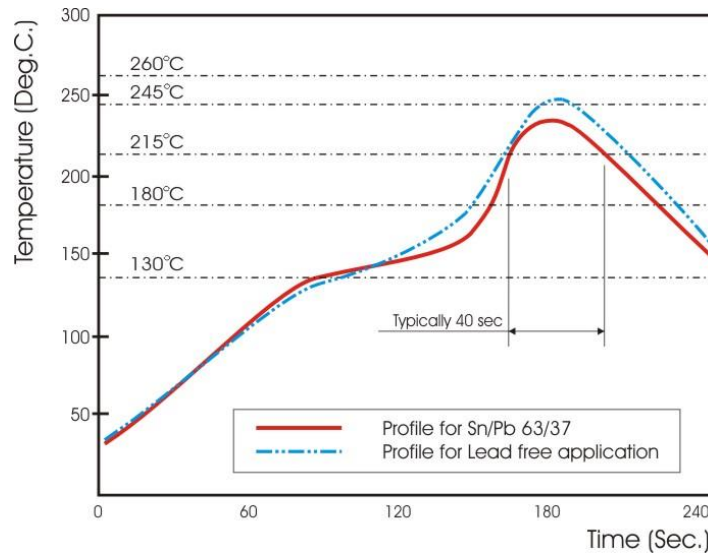
7.3 SOLDERING CONDITION

The robust construction of chip resistors allows them to be completely immersed in a solder bath of 260°C for 10 seconds. Therefore, it is possible to mount Surface Mount Resistors on one side of a PCB and other discrete components on the reverse (mixed PCBs).

Surface Mount Resistors are tested for solderability at 235°C during 2 seconds.

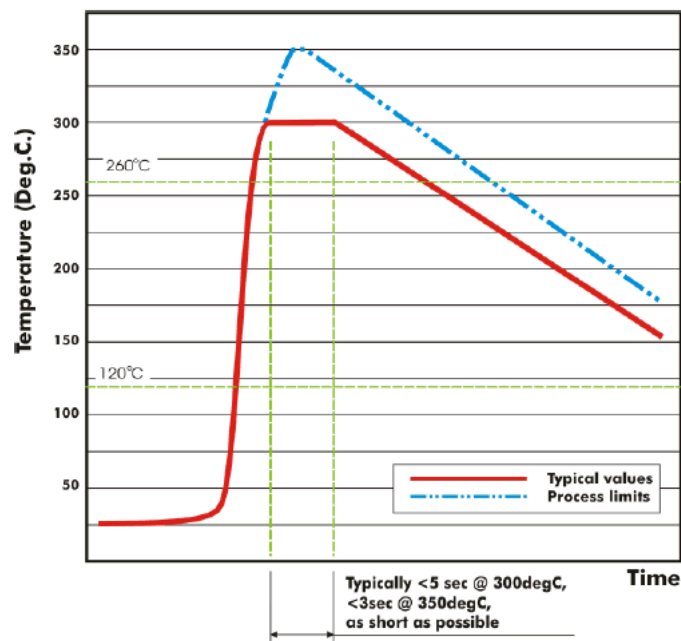
The test condition for no leaching is 260°C for 30 seconds.

Typical examples of soldering processes that provide reliable joints without any damage are given in the figure below.



Infrared soldering profile for Chip Resistors

7.4 Manual soldering (solder iron)



7.5 TEST AND REQUIREMENTS

Basic specification : JIS C 5201-1 : 1998

TEST	PROCEDURE	REQUIREMENT
Clause 4.8 Temperature Coefficient of Resistance (TCR)	Natural resistance change per change in degree centigrade. $\frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 \text{ (ppm/}^\circ\text{C)}$ R ₁ : Resistance at reference temperature R ₂ : Resistance at test temperature t ₁ : 20°C+5°C-1°C	Refer to quick reference data for T.C.R specification
Clause 4.13 Short time overload	5.0× Rated power or Max. Overload Voltage for 5 sec. Measure resistance after 30 minutes..	ΔR/R max. J: ≤ ±(2%+0.1Ω) B,D, F: ≤ ±(1%+0.05Ω)
Clause 4.18 Resistance to soldering heat	Un-mounted chips completely immersed for 10±1second in a SAC solder bath at 260°C±5°C	No visible damage ΔR/R max. J: ≤ ±(1%+0.1Ω) B,D, F: ≤ ±(0.5%+0.05Ω)
Clause 4.17 Solderability	Un-mounted chips completely immersed for 2±0.5 second in a SAC solder bath at 235°C±5°C	Good tinning (>95% covered) No visible damage
Clause 4.18 Leach Test	Un-mounted chips completely immersed for 60±1second in a solder bath at 260°C±5°C	Ditto
Clause 4.19 Temperature cycling	30 minutes at -55°C±3°C, 2~3 minutes at 20°C+5°C-1°C, 30 minutes at +155°C±3°C, 2~3 minutes at 20°C+5°C-1°C, total 5 continuous cycles	No visible damage ΔR/R max. J ≤ ±(1%+0.1Ω) B,D,F ≤ ±(0.5%+0.05Ω)
Clause 4.25 Load life (endurance)	1000 +48/-0 hours, loaded with RCWV or Vmax in chamber controller 70±2°C, 1.5 hours on and 0.5 hours off	No visible damage ΔR/R max. J ≤ ±(3%+0.1Ω) B,D,F ≤ ±(1%+0.05Ω)
Clause 4.24 Load life in Humidity	1000 +48/-0 hours, loaded with RCWV or Vmax in humidity chamber controller at 40°C±2°C and 90~95% relative humidity, 1.5hours on and 0.5 hours off	No visible damage ΔR/R max. J ≤ ±(3%+0.1Ω) B,D,F ≤ ±(1%+0.05Ω)
Clause 4.33 Bending strength	Resistors mounted on a 90mm glass epoxy resin PCB(FR4); bending : 2 mm(2512;2010) 3mm(1206), once for 10 seconds	No visible damage ΔR/R max. J ≤ ±(1%+0.1Ω) B,D,F ≤ ±(0.5%+0.05Ω)
Clause 4.32 Adhesion	Pressurizing force: 5N, Test time: 10±1sec	No remarkable damage or removal of the terminations
Insulation Resistance Clause 4.6	Apply the maximum overload voltage (DC) for 1minute	R ≥ 10GΩ
Dielectric Withstand Voltage Clause 4.7	Apply the maximum overload voltage (AC) for 1 minute	No breakdown or flashover

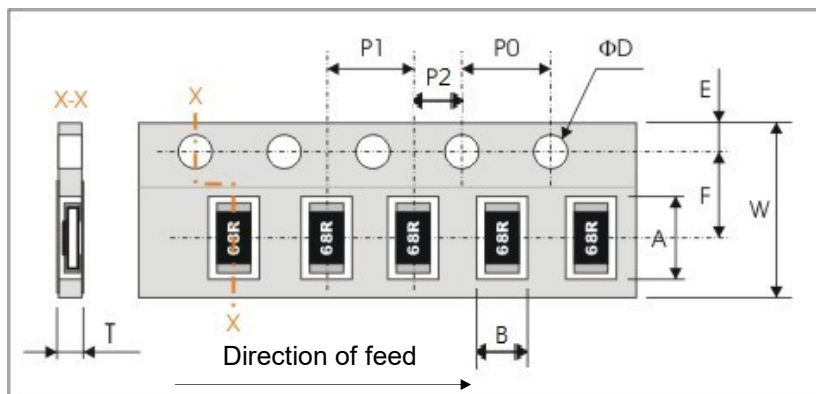
JUMPER (0Ω)

TestMethods (IEC 60115-1)

TEST	PROCEDURE	REQUIREMENT
Short Time Overload	IEC 60115-1 8.1 Max. Overload current for 5s.	P : 0201、01005: $R \leq 40m\Omega$; others: $R \leq 20m\Omega$ F : $R \leq 10m\Omega$ None mechanical damage.
Intermittent Overload	IEC 60115-1 8.4 Max. overload current for 1s ON/ 25s OFF, 10000 cycles.	P : $R \leq 40m\Omega$; F : $R \leq 20m\Omega$ None mechanical damage.
Damp Heat. Steady State	IEC 60115-1 10.4 $40^{\circ}C \pm 2^{\circ}C$, 93%RH $\pm 3\%$ RH, 1000h, rated current for 1.5h ON / 0.5h OFF.	P : $R \leq 40m\Omega$; F : $R \leq 20m\Omega$ None mechanical damage.
Endurance at $70^{\circ}C$	IEC 60115-1 7.1 $70^{\circ}C \pm 2^{\circ}C$, 1000h, rated current for 1.5h ON / 0.5h OFF.	P : $R \leq 40m\Omega$; F : $R \leq 20m\Omega$ None mechanical damage.
Endurance at Upper Category Temperature	IEC 60115-1 7.3 01005: $125^{\circ}C \pm 2^{\circ}C$, 1000h. 0201、0402、0603、0805、1206、1210、2010、2512: $155^{\circ}C \pm 2^{\circ}C$, 1000h.	P : $R \leq 40m\Omega$; F : $R \leq 20m\Omega$ None mechanical damage.
Operation at Low Temperature	IEC 60115-1 10.2 $-55^{\circ}C \pm 5^{\circ}C$, 1h without load, rated current for 45min, 15 min without load.	P : 0201、01005: $R \leq 40m\Omega$; others: $R \leq 20m\Omega$ F : $R \leq 10m\Omega$ None mechanical damage.
Insulation	IEC 60115-1 12.1 Apply DC 100V $\pm$ 15V between substrate and terminations for 1	1000MΩ Min
Voltage Proof	IEC 60115-1 12.2 Apply max . overload voltage (01005: 30VAC, 0201: 50VAC, 0402、0603: 100VAC, 0805: 300VAC, 1206、 1210、2010、2512: 400VAC) of AC RMS at a rate of approximately 100V/s between substrate and terminations for 60s $\pm$ 5s .	No breakdown or flashover

8. PACKAGING

8.1 Paper Tape(CP06, CP10, CP05, CP03, CP02) & Plastic Tape(CP12;CP0A)

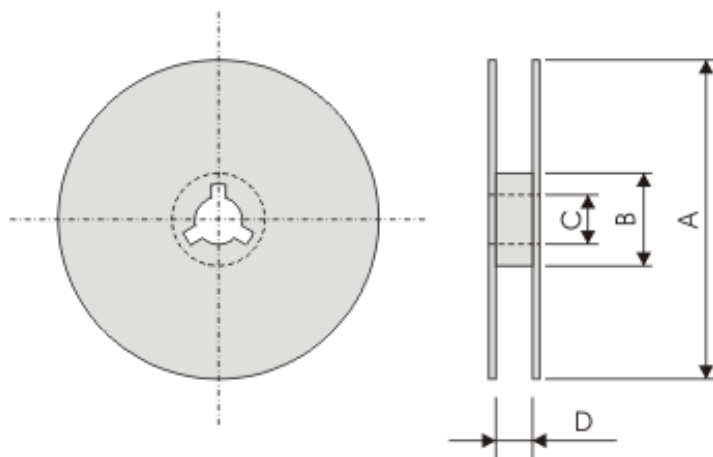


(unit :mm)

Series No.	A	B	W	F	E
CP12	6.90±0.20	3.60±0.20	12.00±0.30	5.50±0.10	1.75±0.10
CP0A	5.50±0.20	2.80±0.20			
CP10	3.60±0.20	2.00±0.20	8.00±0.30	3.50±0.20	1.75±0.10
CP06	3.60±0.20	3.00±0.20	8.00±0.30	3.50±0.20	1.75±0.10
CP05	2.40±0.20	1.65±0.20	8.00±0.30	3.50±0.20	1.75±0.10
CP03	1.90±0.20	1.10±0.20	8.00±0.30	3.50±0.20	1.75±0.10
CP02	1.20±0.10	0.70±0.10	8.00±0.30	3.50±0.20	1.75±0.10

Series No.	P1	P0	P2	ΦD	T
CP12	4.00±0.10	4.00±0.10	2.00±0.10	Φ1.50 ^{+0.1} _{-0.0}	Max. 1.2
CP0A					Max. 1.0
CP06					
CP10	4.00±0.10	4.00±0.10	2.00±0.10	Φ1.50 ^{+0.1} _{-0.0}	Max. 1.0
CP05	4.00±0.10	4.00±0.10	2.00±0.10	Φ1.50 ^{+0.1} _{-0.0}	Max. 1.0
CP03	4.00±0.10	4.00±0.10	2.00±0.10	Φ1.50 ^{+0.1} _{-0.0}	0.65±0.05
CP02	2.00±0.10	4.00±0.10	2.00±0.10	Φ1.50 ^{+0.1} _{-0.0}	0.40±0.05

8.2 Reel dimensions



(unit : mm)

Reel / Tape	A	B	C	D
7" reel for 12mm tape	$\Phi 178.0 \pm 2.0$	$\Phi 60.0 \pm 1.0$	13.0 ± 0.2	12.4 ± 1.0
7" reel for 8mm tape				9.0 ± 0.5

8.3 Taping Quantity:

Tape	Paper Tape						Embossed Tape	Bulk Cassette
	4mm pitch			2mm pitch			4mm pitch	
	7"	10"	13"	7"	10"	13"	7"	
0201	-	-	-	15000	-	-	-	-
0402	-	-	-	10000	20000	40000	-	50000
0603	5000	10000	20000	10000	20000	-	-	20000
0805	5000	10000	20000	-	-	-	-	10000
1206	5000	10000	20000	-	-	-	-	5000

9. Resistance Marking Explanation:

1206 (3216)	3-digits marking	4-digits marking
0805 (2012)	3-digits marking	4-digits marking
0603 (1608)	3-digits marking	3-digits marking
0402(1005)	NO MARKING	

Example

RESISTANCE	10Ω	12Ω	100Ω	6800Ω	47000Ω
3-digits marking	100	120	101	682	473
4-digits marking	10R0	12R0	1000	6801	4702

Remark:

For 0603 above size, each resistor is marked with a four-digit for 1% tolerance and three-digit for 5% tolerance on the protective coating to designate the nominal resistance value.

For 0603, each resistor is marked with a three-digit!

For 0402, no marking !

For Jumper(CP~~Ø~~), 2512/2010 defines 0000, 1206/0805/0603 defines 000.

For Jumper(CP~~Ø~~), Defines 0

10. Performance of Taping :

10.1. Strength of Carrier Tape and Top Cover Tape

-Carrier Tape

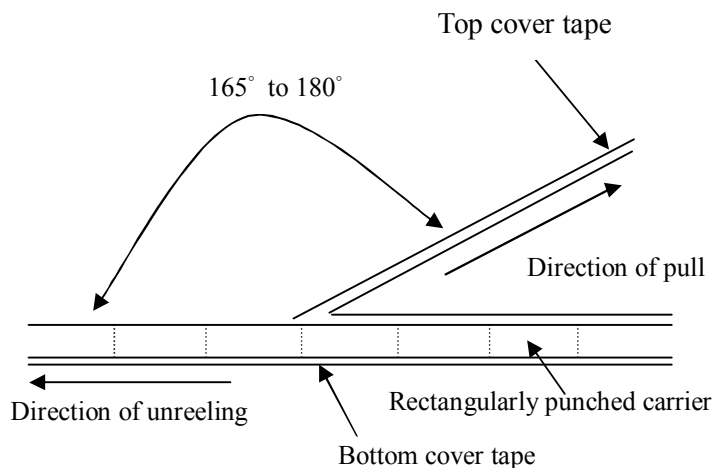
When a tensile force 1.02kgf is applied in the direction of unreeling the tape, the tape shall withstand this force.

-Top cover Tape

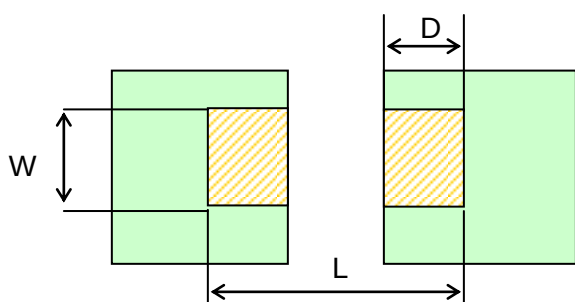
When a tensile force 1.02kgf is applied to the tape, the tape shall withstand this force.

10.2 Peel Force of Top Cover Tape

Unless otherwise specified, the peel force of top cover tape shall be 10.2 to 71.4 g f when the top cover tape is pulled at a speed of 300mm/min with the angle between the taped during peel and the direction of unreeling maintained at 165 to 180° as illustrated in Fig.



11.Recommended Solder Pad Dimensions



Type	W (mm)	L (mm)	D (mm)
01(0201)	0.25~0.3	0.7~0.9	0.3~0.4
02(0402)	0.5~0.6	1.4~1.6	0.4~0.6
03(0603)	0.7~0.9	2.0~2.2	0.8~1.0
05(0805)	1.0~1.4	3.2~3.8	0.9~1.4
06(1206)	2.0~2.4	4.4~5.0	1.2~1.8
10(1210)	2.0~2.4	4.4~5.0	2.3~3.5
0A(2010)	3.3~3.7	5.7~6.5	2.3~3.5
12(2512)	3.6~4.0	7.8~8.6	2.3~3.5

Note :

Due to their rectangular shapes and small tolerances, Surface Mountable Resistors are suitable for handling by automatic placement systems.

Chip placement can be on ceramic substrates and printed-circuit boards (PCBs).

Electrical connection to the circuit is by individual soldering condition.

The end terminations guarantee a reliable contact.